

Computational details for the paper: “Application of benchmark analysis for mixed contaminant exposures: Mutual adjustment of perfluoroalkylate substances associated with immunotoxicity”

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Introduction

This document contains computational details of results in two tables of Budtz-Jørgensen and Grandjean (2018). Thus, we provide SAS output and SAS programs for the linear models in Table 1 & 2. If the exposure slope is positive, the BMD is not defined. In this case BMD=10000 in the program. If the exposure slope is significantly positive (at a 10% level) then the BMDL is not defined. In this case BMDL=10000 in the program.

SAS output

The following pages show SAS-output from the two SAS-programs provided in section *SAS programs*. The output is from regression models with corresponding BMD results. The regression models are run with the procedure PROC REG in SAS. In the regression results the exposure coefficient is always called *eksp*. However, in the title of the output (line 1) the exposure variable is given.

Table 1

Variable names

- log2_tet7: log2 of tetanus concentration at age 7
- log2_dif7: log2 of diphtheria concentration at age 7
- sex: childs sex
- age7: age at 7 year examination
- bosm: booster type at age 5
- pfhx5: PFHxS concentration at age 5
- log2pfos60: log2 of PFOS concentration at age 5
- log2pfoa60: log2 of PFOA concentration at age 5

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The REG Procedure
Model: MODEL1
Dependent Variable: log2_tet7

Number of Observations Read	538
Number of Observations Used	408
Number of Observations with Missing Values	130

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	33.34167	8.33542	2.06	0.0847
Error	403	1626.92924	4.03705		
Corrected Total	407	1660.27091			

Root MSE	2.00924	R-Square	0.0201
Dependent Mean	0.71684	Adj R-Sq	0.0104
Coeff Var	280.29222		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t	90% Confidence Limits
Intercept	1	-5.79189	7.86161	-0.74	0.4617	-18.75288 7.16911
eksp	1	-0.02208	0.09062	-0.24	0.8076	-0.17148 0.12732
sex	1	-0.55357	0.20042	-2.76	0.0060	-0.88400 -0.22315
age7	1	0.89616	1.03236	0.87	0.3859	-0.80584 2.59816
bosm	1	0.05539	0.24526	0.23	0.8214	-0.34896 0.45974

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The REG Procedure
Model: MODEL1
Dependent Variable: log2_tet7

Number of Observations Read 538
Number of Observations Used 408
Number of Observations with Missing Values 130

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	6	70.19835	11.69973	2.95	0.0079
Error	401	1590.07255	3.96527		
Corrected Total	407	1660.27091			

Root MSE 1.99130 R-Square 0.0423
Dependent Mean 0.71684 Adj R-Sq 0.0280
Coeff Var 277.78930

Parameter Estimates

Variable	DF	Parameter	Standard	Pr > t	90% Confidence Limits
		Estimate	Error		
Intercept	1	-3.35844	7.87050	-0.43	0.6698 -16.33423 9.61736
eksp	1	0.04645	0.09279	0.50	0.6169 -0.10653 0.19944
sex	1	-0.59000	0.19920	-2.96	0.0032 -0.91842 -0.26157
age7	1	0.79728	1.02367	0.78	0.4365 -0.89041 2.48497
bosm	1	-0.01861	0.25297	-0.07	0.9414 -0.43567 0.39845
log2pfos60	1	-0.10217	0.26004	-0.39	0.6946 -0.53088 0.32655
log2pfoa60	1	-0.61947	0.24493	-2.53	0.0118 -1.02328 -0.21566

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The REG Procedure
Model: MODEL1
Dependent Variable: log2_tet7

Number of Observations Read 538
Number of Observations Used 408
Number of Observations with Missing Values 130

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	41.06756	10.26689	2.56	0.0385
Error	403	1619.20334	4.01787		
Corrected Total	407	1660.27091			

Root MSE 2.00446 R-Square 0.0247
Dependent Mean 0.71684 Adj R-Sq 0.0151
Coeff Var 279.62591

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t	90% Confidence Limits
Intercept	1	-4.13634	7.92790	-0.52	0.6021	-17.20662 8.93394
eksp	1	-0.22697	0.16120	-1.41	0.1599	-0.49273 0.03879
sex	1	-0.57936	0.20002	-2.90	0.0040	-0.90913 -0.24960
age7	1	0.71069	1.03762	0.68	0.4938	-0.99998 2.42135
bosm	1	0.04006	0.24482	0.16	0.8701	-0.36356 0.44369

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The REG Procedure
Model: MODEL1
Dependent Variable: log2_tet7

Number of Observations Read 538
Number of Observations Used 408
Number of Observations with Missing Values 130

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	6	70.06072	11.67679	2.94	0.0080
Error	401	1590.21019	3.96561		
Corrected Total	407	1660.27091			

Root MSE 1.99138 R-Square 0.0422
Dependent Mean 0.71684 Adj R-Sq 0.0279
Coeff Var 277.80132

Parameter Estimates

Variable	DF	Parameter	Standard	Pr > t	90% Confidence Limits
		Estimate	Error		
Intercept	1	-3.88850	7.90325	-0.49	0.6230 -16.91829 9.14129
eksp	1	0.09325	0.20069	0.46	0.6424 -0.23762 0.42412
sex	1	-0.57479	0.19910	-2.89	0.0041 -0.90303 -0.24655
age7	1	0.87664	1.03297	0.85	0.3966 -0.82638 2.57967
bosm	1	-0.02354	0.25326	-0.09	0.9260 -0.44109 0.39400
log2pfos60	1	-0.11606	0.26508	-0.44	0.6617 -0.55309 0.32097
log2pfoa60	1	-0.65920	0.27375	-2.41	0.0165 -1.11052 -0.20789

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The REG Procedure
Model: MODEL1
Dependent Variable: log2_tet7

Number of Observations Read 538
Number of Observations Used 408
Number of Observations with Missing Values 130

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	59.49796	14.87449	3.74	0.0053
Error	403	1600.77295	3.97214		
Corrected Total	407	1660.27091			

Root MSE 1.99302 R-Square 0.0358
Dependent Mean 0.71684 Adj R-Sq 0.0263
Coeff Var 278.02995

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t	90% Confidence Limits
Intercept	1	-2.44657	7.90360	-0.31	0.7571	-15.47679 10.58365
eksp	1	-1.55245	0.60223	-2.58	0.0103	-2.54530 -0.55959
sex	1	-0.57050	0.19833	-2.88	0.0042	-0.89747 -0.24353
age7	1	0.51961	1.03390	0.50	0.6155	-1.18492 2.22414
bosm	1	0.00592	0.24394	0.02	0.9806	-0.39624 0.40809

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The REG Procedure
Model: MODEL1
Dependent Variable: log2_tet7

Number of Observations Read	538
Number of Observations Used	408
Number of Observations with Missing Values	130

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	6	77.35750	12.89292	3.27	0.0038
Error	401	1582.91340	3.94741		
Corrected Total	407	1660.27091			

Root MSE	1.98681	R-Square	0.0466
Dependent Mean	0.71684	Adj R-Sq	0.0323
Coeff Var	277.16324		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t	90% Confidence Limits
		Intercept	1	-2.18124	7.90126	-0.28
eksp	1	-0.97907	0.68126	-1.44	0.1515	-2.10223 0.14410
sex	1	-0.58741	0.19811	-2.96	0.0032	-0.91403 -0.26078
age7	1	0.59366	1.03215	0.58	0.5655	-1.10800 2.29533
bosm	1	-0.01321	0.25241	-0.05	0.9583	-0.42935 0.40294
log2pfos60	1	0.00771	0.26690	0.03	0.9770	-0.43232 0.44773
log2pfoa60	1	-0.49912	0.25100	-1.99	0.0474	-0.91294 -0.08530

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The REG Procedure
Model: MODEL1
Dependent Variable: log2_dif7

Number of Observations Read 538
Number of Observations Used 408
Number of Observations with Missing Values 130

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	37.27835	9.31959	2.68	0.0312
Error	403	1399.21317	3.47199		
Corrected Total	407	1436.49152			

Root MSE 1.86333 R-Square 0.0260
Dependent Mean -0.52360 Adj R-Sq 0.0163
Coeff Var -355.86615

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t	90% Confidence Limits
Intercept	1	-2.05499	7.29070	-0.28	0.7782	-14.07475 9.96478
eksp	1	-0.02644	0.08404	-0.31	0.7532	-0.16500 0.11211
sex	1	-0.51471	0.18587	-2.77	0.0059	-0.82114 -0.20829
age7	1	0.21044	0.95739	0.22	0.8261	-1.36796 1.78884
bosm	1	0.32593	0.22745	1.43	0.1526	-0.04906 0.70091

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The REG Procedure
Model: MODEL1
Dependent Variable: log2_dif7

Number of Observations Read	538
Number of Observations Used	408
Number of Observations with Missing Values	130

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	6	58.92549	9.82091	2.86	0.0097
Error	401	1377.56603	3.43533		
Corrected Total	407	1436.49152			

Root MSE	1.85346	R-Square	0.0410
Dependent Mean	-0.52360	Adj R-Sq	0.0267
Coeff Var	-353.98208		

Parameter Estimates

Variable	DF	Parameter	Standard				90% Confidence Limits
		Estimate	Error	t Value	Pr > t		
Intercept	1	0.41567	7.32571	0.06	0.9548	-11.66196	12.49329
eksp	1	0.02717	0.08637	0.31	0.7533	-0.11523	0.16957
sex	1	-0.53034	0.18542	-2.86	0.0045	-0.83603	-0.22465
age7	1	0.14805	0.95281	0.16	0.8766	-1.42282	1.71892
bosm	1	0.20764	0.23546	0.88	0.3784	-0.18055	0.59582
log2pfos60	1	-0.33453	0.24204	-1.38	0.1677	-0.73357	0.06451
log2pfoa60	1	-0.28658	0.22798	-1.26	0.2095	-0.66244	0.08928

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The REG Procedure
Model: MODEL1
Dependent Variable: log2_dif7

Number of Observations Read 538
Number of Observations Used 408
Number of Observations with Missing Values 130

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	39.87710	9.96928	2.88	0.0227
Error	403	1396.61442	3.46554		
Corrected Total	407	1436.49152			

Root MSE 1.86160 R-Square 0.0278
Dependent Mean -0.52360 Adj R-Sq 0.0181
Coeff Var -355.53552

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t	90% Confidence Limits
Intercept	1	-1.03636	7.36284	-0.14	0.8881	-13.17507 11.10234
eksp	1	-0.13795	0.14971	-0.92	0.3574	-0.38476 0.10887
sex	1	-0.53252	0.18576	-2.87	0.0044	-0.83877 -0.22626
age7	1	0.09466	0.96366	0.10	0.9218	-1.49408 1.68340
bosm	1	0.31794	0.22737	1.40	0.1628	-0.05692 0.69280

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The REG Procedure
Model: MODEL1
Dependent Variable: log2_dif7

Number of Observations Read	538
Number of Observations Used	408
Number of Observations with Missing Values	130

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	6	60.10837	10.01806	2.92	0.0085
Error	401	1376.38315	3.43238		
Corrected Total	407	1436.49152			

Root MSE	1.85267	R-Square	0.0418
Dependent Mean	-0.52360	Adj R-Sq	0.0275
Coeff Var	-353.83007		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t	90% Confidence Limits
		Intercept	1	-0.16814	7.35272	-0.02
eksp	1	0.12436	0.18671	0.67	0.5057	-0.18346 0.43219
sex	1	-0.51624	0.18523	-2.79	0.0056	-0.82161 -0.21086
age7	1	0.24345	0.96102	0.25	0.8001	-1.34095 1.82784
bosm	1	0.20053	0.23562	0.85	0.3952	-0.18793 0.58899
log2pfos60	1	-0.36262	0.24662	-1.47	0.1422	-0.76921 0.04397
log2pfoa60	1	-0.35457	0.25468	-1.39	0.1646	-0.77444 0.06531

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The REG Procedure
Model: MODEL1
Dependent Variable: log2_dif7

Number of Observations Read	538
Number of Observations Used	408
Number of Observations with Missing Values	130

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	45.69349	11.42337	3.31	0.0110
Error	403	1390.79803	3.45111		
Corrected Total	407	1436.49152			

Root MSE	1.85772	R-Square	0.0318
Dependent Mean	-0.52360	Adj R-Sq	0.0222
Coeff Var	-354.79441		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t	90% Confidence Limits
Intercept	1	-0.11486	7.36702	-0.02	0.9876	-12.26045 12.03074
eksp	1	-0.89428	0.56134	-1.59	0.1119	-1.81973 0.03118
sex	1	-0.52671	0.18486	-2.85	0.0046	-0.83148 -0.22193
age7	1	-0.00969	0.96371	-0.01	0.9920	-1.59850 1.57912
bosm	1	0.29884	0.22737	1.31	0.1895	-0.07602 0.67370

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The REG Procedure
Model: MODEL1
Dependent Variable: log2_dif7

Number of Observations Read	538
Number of Observations Used	408
Number of Observations with Missing Values	130

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	6	59.33785	9.88964	2.88	0.0093
Error	401	1377.15367	3.43430		
Corrected Total	407	1436.49152			

Root MSE	1.85319	R-Square	0.0413
Dependent Mean	-0.52360	Adj R-Sq	0.0270
Coeff Var	-353.92910		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t	90% Confidence Limits
		Intercept	1	0.72703	7.36986	0.10
eksp	1	-0.29741	0.63544	-0.47	0.6400	-1.34503 0.75022
sex	1	-0.52724	0.18479	-2.85	0.0046	-0.83189 -0.22258
age7	1	0.09012	0.96273	0.09	0.9255	-1.49710 1.67734
bosm	1	0.20948	0.23544	0.89	0.3741	-0.17868 0.59763
log2pfos60	1	-0.29757	0.24895	-1.20	0.2327	-0.70799 0.11286
log2pfoa60	1	-0.24440	0.23412	-1.04	0.2972	-0.63038 0.14159

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Obs	dependentny	exposure	model	adjust	bmd	bmdl
1	tetanus	pfhxs5	linear	no	3.351	0.432
2	tetanus	pfhxs5	linear	yes	10000	0.695
3	tetanus	pfna5	linear	no	0.326	0.150
4	tetanus	pfna5	linear	yes	10000	0.311
5	tetanus	pfda5	linear	no	0.048	0.029
6	tetanus	pfda5	linear	yes	0.076	0.035
7	diphtheria	pfhxs5	linear	no	2.799	0.448
8	diphtheria	pfhxs5	linear	yes	10000	0.642
9	diphtheria	pfna5	linear	no	0.536	0.192
10	diphtheria	pfna5	linear	yes	10000	0.403
11	diphtheria	pfda5	linear	no	0.083	0.041
12	diphtheria	pfda5	linear	yes	0.249	0.055

Table 2

Variable names

- ltet51: log2 of tetanus concentration at age 5
- ldif51: log2 of diphtheria concentration at age 5
- sex: childs sex
- age5a: age at 5 year examination
- cohort5: binary variable allowing for difference between cohorts
- vsex: interaction term between cohort and sex
- vage: interaction term between cohort and age
- matpfhxS: maternal concentration of PFHxS
- lmatpfos: log2 maternal concentration of PFOS
- lmatpfoa: log2 maternal concentration of PFOA

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The REG Procedure
 Model: MODEL1
 Dependent Variable: ltet51

Number of Observations Read	900
Number of Observations Used	852
Number of Observations with Missing Values	48

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	6	116.83263	19.47210	5.55	<.0001
Error	845	2965.35616	3.50930		
Corrected Total	851	3082.18878			

Root MSE	1.87331	R-Square	0.0379
Dependent Mean	-2.49439	Adj R-Sq	0.0311
Coeff Var	-75.10113		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	Intercept	1	-8.75803	7.24827	-1.21	0.2273

eksp		1	-0.02382	0.01832	-1.30	0.1939
sex		1	-0.22134	0.16645	-1.33	0.1839
AGE5A	Age, first 5yr exam	1	1.37120	1.46049	0.94	0.3481
cohort5		1	7.49814	10.66691	0.70	0.4823
vsex		1	0.46818	0.26245	1.78	0.0748
vage		1	-1.72025	2.13337	-0.81	0.4203

Parameter Estimates

Variable	Label	DF	90% Confidence Limits	
Intercept	Intercept	1	-20.69345	3.17740
eksp		1	-0.05400	0.00635
sex		1	-0.49542	0.05274
AGE5A	Age, first 5yr exam	1	-1.03373	3.77613
cohort5		1	-10.06662	25.06291
vsex		1	0.03601	0.90035
vage		1	-5.23317	1.79268

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The REG Procedure
Model: MODEL1
Dependent Variable: ltet51

Number of Observations Read	900
Number of Observations Used	852
Number of Observations with Missing Values	48

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	8	140.30921	17.53865	5.03	<.0001
Error	843	2941.87957	3.48977		
Corrected Total	851	3082.18878			

Root MSE	1.86809	R-Square	0.0455
Dependent Mean	-2.49439	Adj R-Sq	0.0365
Coeff Var	-74.89193		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	Intercept	1	-8.52728	7.29550	-1.17	0.2428
eksp		1	-0.01899	0.01837	-1.03	0.3017
sex		1	-0.20352	0.16648	-1.22	0.2219
AGE5A	Age, first 5yr exam	1	1.37966	1.45831	0.95	0.3444
cohort5		1	6.37051	10.69639	0.60	0.5516
vsex		1	0.40073	0.26418	1.52	0.1297
vage		1	-1.54236	2.13505	-0.72	0.4702
lpfosmat		1	0.03365	0.14916	0.23	0.8216
lpfoamat		1	-0.28298	0.12303	-2.30	0.0217

Parameter Estimates

Variable	Label	DF	90% Confidence Limits
Intercept	Intercept	1	-20.54051 3.48594
eksp		1	-0.04924 0.01127
sex		1	-0.47766 0.07061
AGE5A	Age, first 5yr exam	1	-1.02170 3.78101
cohort5		1	-11.24285 23.98387
vsex		1	-0.03429 0.83575
vage		1	-5.05807 1.97334
lpfosmat		1	-0.21197 0.27928
lpfoamat		1	-0.48557 -0.08039

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The REG Procedure
Model: MODEL1
Dependent Variable: ltet51

Number of Observations Read	900
Number of Observations Used	852
Number of Observations with Missing Values	48

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	6	110.90508	18.48418	5.26	<.0001
Error	845	2971.28370	3.51631		
Corrected Total	851	3082.18878			

Root MSE	1.87518	R-Square	0.0360
Dependent Mean	-2.49439	Adj R-Sq	0.0291
Coeff Var	-75.17615		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	Intercept	1	-10.12444	7.20171	-1.41	0.1601
eksp		1	0.00676	0.20387	0.03	0.9736
sex		1	-0.21477	0.16673	-1.29	0.1981
AGE5A	Age, first 5yr exam	1	1.61687	1.45230	1.11	0.2659
cohort5		1	8.83480	10.63126	0.83	0.4062
vsex		1	0.46209	0.26268	1.76	0.0789
vage		1	-1.96224	2.12814	-0.92	0.3568

Parameter Estimates

Variable	Label	DF	90% Confidence Limits
Intercept	Intercept	1	-21.98321 1.73433
eksp		1	-0.32894 0.34246
sex		1	-0.48931 0.05978
AGE5A	Age, first 5yr exam	1	-0.77457 4.00831
cohort5		1	-8.67126 26.34085
vsex		1	0.02955 0.89463
vage		1	-5.46657 1.54209

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The REG Procedure
Model: MODEL1
Dependent Variable: ltet51

Number of Observations Read	900
Number of Observations Used	852
Number of Observations with Missing Values	48

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	8	141.54338	17.69292	5.07	<.0001
Error	843	2940.64540	3.48831		
Corrected Total	851	3082.18878			

Root MSE	1.86770	R-Square	0.0459
Dependent Mean	-2.49439	Adj R-Sq	0.0369
Coeff Var	-74.87622		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	Intercept	1	-9.60911	7.22535	-1.33	0.1839
eksp		1	0.29276	0.24548	1.19	0.2333
sex		1	-0.19046	0.16648	-1.14	0.2529
AGE5A	Age, first 5yr exam	1	1.63132	1.44726	1.13	0.2600
cohort5		1	6.76013	10.66355	0.63	0.5263
vsex		1	0.39860	0.26407	1.51	0.1316
vage		1	-1.64585	2.12852	-0.77	0.4396
lpfosmat		1	-0.05622	0.16640	-0.34	0.7356
lpfoamat		1	-0.31132	0.12354	-2.52	0.0119

Parameter Estimates

Variable	Label	DF	90% Confidence Limits
Intercept	Intercept	1	-21.50683 2.28862
eksp		1	-0.11145 0.69698
sex		1	-0.46460 0.08368
AGE5A	Age, first 5yr exam	1	-0.75182 4.01447
cohort5		1	-10.79915 24.31941
vsex		1	-0.03623 0.83344
vage		1	-5.15081 1.85911
lpfosmat		1	-0.33022 0.21778
lpfoamat		1	-0.51476 -0.10789

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The REG Procedure
Model: MODEL1
Dependent Variable: ltet51

Number of Observations Read	900
Number of Observations Used	852
Number of Observations with Missing Values	48

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	6	112.84012	18.80669	5.35	<.0001
Error	845	2969.34866	3.51402		
Corrected Total	851	3082.18878			

Root MSE	1.87457	R-Square	0.0366
Dependent Mean	-2.49439	Adj R-Sq	0.0298
Coeff Var	-75.15167		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	Intercept	1	-9.76429	7.19327	-1.36	0.1750
eksp		1	-0.34295	0.46170	-0.74	0.4578
sex		1	-0.22118	0.16669	-1.33	0.1849
AGE5A	Age, first 5yr exam	1	1.56711	1.45084	1.08	0.2804
cohort5		1	8.71184	10.62612	0.82	0.4125
vsex		1	0.47080	0.26285	1.79	0.0736
vage		1	-1.93854	2.12698	-0.91	0.3623

Parameter Estimates

Variable	Label	DF	90% Confidence Limits
Intercept	Intercept	1	-21.60916 2.08058
eksp		1	-1.10321 0.41730
sex		1	-0.49566 0.05331
AGE5A	Age, first 5yr exam	1	-0.82194 3.95615
cohort5		1	-8.78575 26.20943
vsex		1	0.03798 0.90363
vage		1	-5.44096 1.56387

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The REG Procedure
Model: MODEL1
Dependent Variable: ltet51

Number of Observations Read	900
Number of Observations Used	852
Number of Observations with Missing Values	48

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	8	136.59785	17.07473	4.89	<.0001
Error	843	2945.59093	3.49418		
Corrected Total	851	3082.18878			

Root MSE	1.86927	R-Square	0.0443
Dependent Mean	-2.49439	Adj R-Sq	0.0352
Coeff Var	-74.93916		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	Intercept	1	-9.55389	7.23185	-1.32	0.1868
eksp		1	0.03765	0.55384	0.07	0.9458
sex		1	-0.19766	0.16660	-1.19	0.2358
AGE5A	Age, first 5yr exam	1	1.57171	1.44779	1.09	0.2780
cohort5		1	7.30919	10.67813	0.68	0.4938
vsex		1	0.39310	0.26441	1.49	0.1375
vage		1	-1.71475	2.13137	-0.80	0.4213
lpfosmat		1	0.02639	0.16938	0.16	0.8762
lpfoamat		1	-0.29359	0.12284	-2.39	0.0171

Parameter Estimates

Variable	Label	DF	90% Confidence Limits
Intercept	Intercept	1	-21.46232 2.35454
eksp		1	-0.87434 0.94964
sex		1	-0.47200 0.07668
AGE5A	Age, first 5yr exam	1	-0.81231 3.95574
cohort5		1	-10.27409 24.89247
vsex		1	-0.04229 0.82849
vage		1	-5.22440 1.79491
lpfosmat		1	-0.25251 0.30529
lpfoamat		1	-0.49586 -0.09132

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The REG Procedure
Model: MODEL1
Dependent Variable: ldif51

Number of Observations Read	900
Number of Observations Used	853
Number of Observations with Missing Values	47

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	6	101.23943	16.87324	4.34	0.0003
Error	846	3290.59775	3.88960		
Corrected Total	852	3391.83717			

Root MSE	1.97221	R-Square	0.0298
Dependent Mean	-3.09935	Adj R-Sq	0.0230
Coeff Var	-63.63285		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	Intercept	1	1.91923	7.63241	0.25	0.8015
eksp		1	-0.03783	0.01927	-1.96	0.0500
sex		1	-0.57021	0.17498	-3.26	0.0012
AGE5A	Age, first 5yr exam	1	-0.90799	1.53787	-0.59	0.5551
cohort5		1	17.48267	11.23103	1.56	0.1199
vsex		1	1.04383	0.27615	3.78	0.0002
vage		1	-3.61056	2.24618	-1.61	0.1083

Parameter Estimates

Variable	Label	DF	90% Confidence Limits
Intercept	Intercept	1	-10.64873 14.48719
eksp		1	-0.06957 -0.00609
sex		1	-0.85835 -0.28207
AGE5A	Age, first 5yr exam	1	-3.44033 1.62435
cohort5		1	-1.01099 35.97633
vsex		1	0.58910 1.49855
vage		1	-7.30924 0.08812

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The REG Procedure
Model: MODEL1
Dependent Variable: ldif51

Number of Observations Read	900
Number of Observations Used	853
Number of Observations with Missing Values	47

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	8	138.67191	17.33399	4.50	<.0001
Error	844	3253.16526	3.85446		
Corrected Total	852	3391.83717			

Root MSE	1.96328	R-Square	0.0409
Dependent Mean	-3.09935	Adj R-Sq	0.0318
Coeff Var	-63.34481		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	Intercept	1	4.43054	7.67087	0.58	0.5637
eksp		1	-0.03279	0.01928	-1.70	0.0894
sex		1	-0.57957	0.17466	-3.32	0.0009
AGE5A	Age, first 5yr exam	1	-1.08216	1.53303	-0.71	0.4804
cohort5		1	14.03908	11.24451	1.25	0.2122
vsex		1	1.03956	0.27737	3.75	0.0002
vage		1	-3.05716	2.24436	-1.36	0.1735
lpfosmat		1	-0.30568	0.15687	-1.95	0.0517
lpfoamat		1	-0.12926	0.12911	-1.00	0.3170

Parameter Estimates

Variable	Label	DF	90% Confidence Limits
Intercept	Intercept	1	-8.20079 17.06187
eksp		1	-0.06454 -0.00103
sex		1	-0.86717 -0.29196
AGE5A	Age, first 5yr exam	1	-3.60655 1.44222
cohort5		1	-4.47682 32.55498
vsex		1	0.58282 1.49630
vage		1	-6.75285 0.63854
lpfosmat		1	-0.56399 -0.04737
lpfoamat		1	-0.34186 0.08334

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The REG Procedure
Model: MODEL1
Dependent Variable: ldif51

Number of Observations Read	900
Number of Observations Used	853
Number of Observations with Missing Values	47

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	6	86.48471	14.41412	3.69	0.0013
Error	846	3305.35247	3.90704		
Corrected Total	852	3391.83717			

Root MSE	1.97662	R-Square	0.0255
Dependent Mean	-3.09935	Adj R-Sq	0.0186
Coeff Var	-63.77536		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	Intercept	1	-0.10446	7.59058	-0.01	0.9890
eksp		1	-0.05216	0.21468	-0.24	0.8081
sex		1	-0.56430	0.17551	-3.22	0.0014
AGE5A	Age, first 5yr exam	1	-0.53881	1.53076	-0.35	0.7249
cohort5		1	19.55277	11.20622	1.74	0.0814
vsex		1	1.03586	0.27675	3.74	0.0002
vage		1	-3.98295	2.24323	-1.78	0.0762

Parameter Estimates

Variable	Label	DF	90% Confidence Limits
Intercept	Intercept	1	-12.60354 12.39462
eksp		1	-0.40567 0.30134
sex		1	-0.85331 -0.27528
AGE5A	Age, first 5yr exam	1	-3.05945 1.98183
cohort5		1	1.09997 38.00557
vsex		1	0.58015 1.49156
vage		1	-7.67678 -0.28911

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The REG Procedure
Model: MODEL1
Dependent Variable: ldif51

Number of Observations Read	900
Number of Observations Used	853
Number of Observations with Missing Values	47

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	8	141.26255	17.65782	4.58	<.0001
Error	844	3250.57463	3.85139		
Corrected Total	852	3391.83717			

Root MSE	1.96250	R-Square	0.0416
Dependent Mean	-3.09935	Adj R-Sq	0.0326
Coeff Var	-63.31958		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	Intercept	1	2.59773	7.59434	0.34	0.7324
eksp		1	0.48616	0.25745	1.89	0.0593
sex		1	-0.56023	0.17465	-3.21	0.0014
AGE5A	Age, first 5yr exam	1	-0.65851	1.52073	-0.43	0.6651
cohort5		1	14.72260	11.20810	1.31	0.1893
vsex		1	1.03845	0.27724	3.75	0.0002
vage		1	-3.23483	2.23707	-1.45	0.1485
lpfosmat		1	-0.45500	0.17494	-2.60	0.0095
lpfoamat		1	-0.17593	0.12962	-1.36	0.1750

Parameter Estimates

Variable	Label	DF	90% Confidence Limits
Intercept	Intercept	1	-9.90756 15.10303
eksp		1	0.06223 0.91008
sex		1	-0.84781 -0.27264
AGE5A	Age, first 5yr exam	1	-3.16264 1.84563
cohort5		1	-3.73335 33.17855
vsex		1	0.58192 1.49497
vage		1	-6.91852 0.44886
lpfosmat		1	-0.74307 -0.16694
lpfoamat		1	-0.38937 0.03750

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The REG Procedure
Model: MODEL1
Dependent Variable: ldif51

Number of Observations Read	900
Number of Observations Used	853
Number of Observations with Missing Values	47

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	6	97.49564	16.24927	4.17	0.0004
Error	846	3294.34153	3.89402		
Corrected Total	852	3391.83717			

Root MSE	1.97333	R-Square	0.0287
Dependent Mean	-3.09935	Adj R-Sq	0.0219
Coeff Var	-63.66904		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	Intercept	1	0.55702	7.57149	0.07	0.9414
eksp		1	-0.82478	0.48543	-1.70	0.0897
sex		1	-0.57628	0.17523	-3.29	0.0010
AGE5A	Age, first 5yr exam	1	-0.62648	1.52719	-0.41	0.6817
cohort5		1	19.35985	11.18584	1.73	0.0839
vsex		1	1.05644	0.27654	3.82	0.0001
vage		1	-3.94812	2.23902	-1.76	0.0782

Parameter Estimates

Variable	Label	DF	90% Confidence Limits
Intercept	Intercept	1	-11.91063 13.02466
eksp		1	-1.62412 -0.02545
sex		1	-0.86482 -0.28774
AGE5A	Age, first 5yr exam	1	-3.14124 1.88828
cohort5		1	0.94061 37.77909
vsex		1	0.60108 1.51180
vage		1	-7.63503 -0.26122

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The REG Procedure
Model: MODEL1
Dependent Variable: ldif51

Number of Observations Read	900
Number of Observations Used	853
Number of Observations with Missing Values	47

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	8	127.53355	15.94169	4.12	<.0001
Error	844	3264.30362	3.86766		
Corrected Total	852	3391.83717			

Root MSE	1.96664	R-Square	0.0376
Dependent Mean	-3.09935	Adj R-Sq	0.0285
Coeff Var	-63.45316		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	Intercept	1	2.63339	7.61132	0.35	0.7294
eksp		1	0.02112	0.58127	0.04	0.9710
sex		1	-0.57189	0.17499	-3.27	0.0011
AGE5A	Age, first 5yr exam	1	-0.74957	1.52331	-0.49	0.6228
cohort5		1	15.72772	11.23798	1.40	0.1620
vsex		1	1.02915	0.27792	3.70	0.0002
vage		1	-3.36587	2.24298	-1.50	0.1338
lpfosmat		1	-0.31156	0.17827	-1.75	0.0809
lpfoamat		1	-0.14656	0.12906	-1.14	0.2564

Parameter Estimates

Variable	Label	DF	90% Confidence Limits
Intercept	Intercept	1	-9.89988 15.16665
eksp		1	-0.93603 0.97827
sex		1	-0.86005 -0.28374
AGE5A	Age, first 5yr exam	1	-3.25795 1.75881
cohort5		1	-2.77744 34.23287
vsex		1	0.57152 1.48679
vage		1	-7.05931 0.32756
lpfosmat		1	-0.60511 -0.01800
lpfoamat		1	-0.35907 0.06596

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Obs	dependentny	exposure	model	adjust	bmd	bmdl
1	tetanus	matPFHxS	linear	no	3.106	1.370
2	tetanus	matPFHxS	linear	yes	3.897	1.503
3	tetanus	matPFNA	linear	no	10000	0.225
4	tetanus	matPFNA	linear	yes	10000	0.664
5	tetanus	matPFDA	linear	no	0.216	0.067
6	tetanus	matPFDA	linear	yes	10000	0.085
7	diphtheria	matPFHxS	linear	no	1.956	1.064
8	diphtheria	matPFHxS	linear	yes	2.257	1.147
9	diphtheria	matPFNA	linear	no	1.419	0.182
10	diphtheria	matPFNA	linear	yes	10000	10000
11	diphtheria	matPFDA	linear	no	0.090	0.046
12	diphtheria	matPFDA	linear	yes	10000	0.079

SAS programs

Table 1

```
libname sasdat "P:\compu19\cohort3\sasdata";
```

```
DATA Temp;
  Set sasdat.bmd17;
RUN;
```

```
%macro drlinje1(respons, ekspo);
```

```
data tempi;
set temp;
eksp=&ekspo;
run;
```

```
proc reg data=tempi outest=esti0 tableout edf noprint;
model &ekspo = ;
run;
```

```
data esti0;
set esti0;
if _TYPE_='PARMS';
```

```
keep _DEPVAR_;
run;

data esti0;
set esti0;
exposure=_DEPVAR_;
keep exposure;
run;

proc means data=tempi p25 noprint;
var eksp;
output out=c p25=p25;
run;

data c;
set c;
CALL SYMPUT("p25",p25);
run;

proc reg data=tempi;
model &respons = eksp sex age7 bosm /clb alpha=0.1;
ods output ParameterEstimates=alfa0;
output out=esti_1 r=res;
title "eksp is &ekspo";
run;

data esti_1;
set esti_1;
keep res eksp;
run;

proc means data=esti_1 noprint;
var res;
output out=e1 n=n USS=sumres2;
run;
```

```

data e1;
set e1;
m2lnl=(n*log(sumres2/n)+n*log(2*3.14159265)+n);
keep m2lnl n;
run;

proc means data=esti_1 noprint;
var res;
where eksp<&p25;
output out=e n=n1 USS=sumres21;
run;

data e;
set e;
low_m2lnl=n1*log(sumres21/n1)+n1*log(2*3.14159265)+n1;
run;

data alfa0;
set alfa0;
if Variable='eksp';
keep dependent estimate lowercl stderr probt;
run;

data alfa0;
merge esti0 alfa0 e e1;
model='linear';
metode='relative';
run;

data alfa0;
set alfa0;
do bmr=0.01 to 0.2 by 0.01;
output;
end;

```

```
data alfa0;
set alfa0;
bmd=log2(1-bmr)/estimate;
bmdl=log2(1-bmr)/lowercl;
run;

data alfa0;
set alfa0;
num+1;
run;

data alfa;
set alfa0;
keep bmr BMD BMDL estimate dependent exposure metode model num m2lnl low_m2lnl n1
probt;
run;

data alfa5;
set alfa;
if num=5;
run;

data alfa10;
set alfa;
if num=10;
bmd10=bmd;
bmdl10=bmdl;
keep bmd10 bmdl10;
run;

data al;
merge alfa5 alfa10;
run;
```

```
data al;
merge al;
adjust="no ";
run;

data saml;
set saml al;
run;

%mend drlinje1;

%macro drlinje2(respons, ekspo,conf,conf2);

data tempi;
set temp;
eksp=&ekspo;
run;

proc reg data=tempi outest=esti0 tableout edf noprint;
model &ekspo = ;
run;

data esti0;
set esti0;
if _TYPE_='PARMS';
keep _DEPVAR_;
run;

data esti0;
set esti0;
exposure=_DEPVAR_;
keep exposure;
run;

proc means data=tempi p25 noprint;
var eksp;
output out=c p25=p25;
run;
```

```

data c;
set c;
CALL SYMPUT("p25",p25);
run;

proc reg data=tempi;
model &respons = eksp sex age7 bosm &conf &conf2 /clb alpha=0.1;
ods output ParameterEstimates=alfa0;
output out=esti_1 r=res;
title "eksp is &ekspo";
run;

data esti_1;
set esti_1;
keep res eksp;
run;

proc means data=esti_1 noprint;
var res;
output out=e1 n=n USS=sumres2;
run;

data e1;
set e1;
m2lnl=(n*log(sumres2/n)+n*log(2*3.14159265)+n);
keep m2lnl n;
run;

proc means data=esti_1 noprint;
var res;
where eksp<&p25;
output out=e n=n1 USS=sumres21;
run;

data e;

```

```
set e;
low_m2lnl=n1*log(sumres21/n1)+n1*log(2*3.14159265)+n1;
run;
```

```
data alfa0;
set alfa0;
if Variable='eksp';
keep dependent estimate lowercl stderr probt;
run;
```

```
data alfa0;
merge esti0 alfa0 e e1;
model='linear';
metode='relative';
run;
```

```
data alfa0;
set alfa0;
do bmr=0.01 to 0.2 by 0.01;
output;
end;
```

```
data alfa0;
set alfa0;
bmd=log2(1-bmr)/estimate;
bmdl=log2(1-bmr)/lowercl;
run;
```

```
data alfa0;
set alfa0;
num+1;
run;
```

```
data alfa;
set alfa0;
keep bmr BMD BMDL estimate dependent exposure metode model num m2lnl low_m2lnl n1
probt;
run;

data alfa5;
set alfa;
if num=5;
run;

data alfa10;
set alfa;
if num=10;
bmd10=bmd;
bmdl10=bmdl;
keep bmd10 bmdl10;
run;

data al;
merge alfa5 alfa10;
run;

proc reg data=tempi outest=estic tableout edf noprint;
model &conf = ;
run;

data estic;
set estic;
if _TYPE_='PARMS';
keep _DEPVAR_;
run;

data estic;
set estic;
confounder=_DEPVAR_;
keep confounder;
```

```

run;

proc reg data=tempi outest=estic2 tableout edf noprint;
model &conf2 = ;
run;

data estic2;
set estic2;
if _TYPE_='PARMS';
keep _DEPVAR_;
run;

data estic2;
set estic2;
confounder2=_DEPVAR_;
keep confounder2;
run;

data al;
merge al estic estic2;
adjust="yes ";
run;

data saml;
set saml al;
run;

%mend drlinje2;
data saml;
run;

%drlinje1(log2_tet7, pfhxs5);
%drlinje2(log2_tet7, pfhxs5,log2pfos60,log2pfoa60);

%drlinje1(log2_tet7, pfna5);
%drlinje2(log2_tet7, pfna5,log2pfos60,log2pfoa60);

```

```
%drlinje1(log2_tet7, pfda5);
%drlinje2(log2_tet7, pfda5,log2pfos60,log2pfoa60);

%drlinje1(log2_dif7, pfhxs5);
%drlinje2(log2_dif7, pfhxs5,log2pfos60,log2pfoa60);

%drlinje1(log2_dif7, pfna5);
%drlinje2(log2_dif7, pfna5,log2pfos60,log2pfoa60);

%drlinje1(log2_dif7, pfda5);
%drlinje2(log2_dif7, pfda5,log2pfos60,log2pfoa60);
```

```
data saml;
set saml;
if dependent='log2_tet7' then dependentny='tetanus';
if dependent='log2_dif7' then dependentny='diphtheria';
run;
```

```
data saml;
set saml;
format bmd bmdl bmd10 bmdl10 5.3;
format m2lnl low_m2lnl 8.2;
format probt 6.4;
run;
```

```
data saml;
set saml;
if bmd=. then delete;
    if bmd<0 then bmd=10000;
if bmd10<0 then bmd10=10000;
keep dependentny exposure model adjust bmd bmdl bmd10 bmdl10;
run;
```

```
proc print data=saml;
```

```
var dependentny exposure model adjust bmd bmdl;  
run;
```

Table 2

```
libname sasdat1 "P:\compu18\efter\cohort5\sasdata";
```

```
data temp;  
set sasdat1.sam35;  
if age5a=. then delete;  
vage=cohort5*age5a;  
vsex=cohort5*sex;  
run;
```

```
%macro drlinje1(respons, ekspo);
```

```
data tempi;  
set temp;  
eksp=&ekspo;  
run;
```

```
proc reg data=tempi outest=esti0 tableout edf noprint;  
model &ekspo = ;  
run;
```

```
data esti0;  
set esti0;  
if _TYPE_='PARMS';  
keep _DEPVAR_;  
run;
```

```
data esti0;  
set esti0;  
exposure=_DEPVAR_;  
keep exposure;  
run;
```

```

proc means data=tempi p25 noprint;
var eksp;
output out=c p25=p25;
run;

data c;
set c;
CALL SYMPUT("p25",p25);
run;

proc reg data=tempi;
model &respons = eksp sex age5a cohort5 vsex vage /clb alpha=0.1;
ods output ParameterEstimates=alfa0;
output out=esti_1 r=res;
title "eksp is &ekspo";
run;

data esti_1;
set esti_1;
keep res eksp;
run;

proc means data=esti_1 noprint;
var res;
output out=e1 n=n USS=sumres2;
run;

data e1;
set e1;
m2lnl=(n*log(sumres2/n)+n*log(2*3.14159265)+n);
keep m2lnl n;
run;

proc means data=esti_1 noprint;
var res;
where eksp<&p25;

```

```

output out=e n=n1 USS=sumres21;
run;

data e;
set e;
low_m2lnl=n1*log(sumres21/n1)+n1*log(2*3.14159265)+n1;
run;

data alfa0;
set alfa0;
if Variable='eksp';
keep dependent estimate lowercl stderr;
run;

data alfa0;
merge esti0 alfa0 e e1;
model='linear';
metode='relative';
run;

data alfa0;
set alfa0;
do bmr=0.01 to 0.2 by 0.01;
output;
end;

data alfa0;
set alfa0;
bmd=log2(1-bmr)/estimate;
bmdl=log2(1-bmr)/lowercl;
run;

data alfa0;

```

```

set alfa0;
num+1;
run;

data alfa;
set alfa0;
keep bmr BMD BMDL estimate dependent exposure metode model num m2lnl low_m2lnl n1;
run;

data alfa5;
set alfa;
if num=5;
run;

data alfa10;
set alfa;
if num=10;
bmd10=bmd;
bmdl10=bmdl;
keep bmd10 bmdl10;
run;

data al;
merge alfa5 alfa10;
adjust="no ";
run;

data saml;
set saml al;
run;

%mend drlinje1;

%macro drlinje2(respons, ekspo,conf,conf2);

data tempi;

```

```

set temp;
eksp=&ekspo;
run;

proc reg data=tempi outest=esti0 tableout edf noprint;
model &ekspo = ;
run;

data esti0;
set esti0;
if _TYPE_='PARMS';
keep _DEPVAR_;
run;

data esti0;
set esti0;
exposure=_DEPVAR_;
keep exposure;
run;

proc means data=tempi p25 noprint;
var eksp;
output out=c p25=p25;
run;

data c;
set c;
CALL SYMPUT("p25",p25);
run;

proc reg data=tempi;
model &respons = eksp sex age5a cohort5 vsex vage &conf &conf2/clb alpha=0.1;
ods output ParameterEstimates=alfa0;
output out=esti_1 r=res;
title "eksp is &ekspo";
run;

```

```

data esti_1;
set esti_1;
keep res eksp;
run;

proc means data=esti_1 nopolish;
var res;
output out=e1 n=n USS=sumres2;
run;

data e1;
set e1;
m2lnl=(n*log(sumres2/n)+n*log(2*3.14159265)+n);
keep m2lnl n;
run;

proc means data=esti_1 nopolish;
var res;
where eksp<&p25;
output out=e n=n1 USS=sumres21;
run;

data e;
set e;
low_m2lnl=n1*log(sumres21/n1)+n1*log(2*3.14159265)+n1;
run;

data alfa0;
set alfa0;
if Variable='eksp';
keep dependent estimate lowercl stderr;
run;

data alfa0;
merge esti0 alfa0 e e1;

```

```
model='linear';
metode='relative';
run;

data alfa0;
set alfa0;
do bmr=0.01 to 0.2 by 0.01;
output;
end;

data alfa0;
set alfa0;
bmd=log2(1-bmr)/estimate;
bmdl=log2(1-bmr)/lowercl;
run;

data alfa0;
set alfa0;
num+1;
run;

data alfa;
set alfa0;
keep bmr BMD BMDL estimate dependent exposure metode model num m2lnl low_m2lnl n1;
run;

data alfa5;
set alfa;
if num=5;
run;

data alfa10;
set alfa;
if num=10;
bmd10=bmd;
bmdl10=bmdl;
```

```
keep bmd10 bmdl10;
run;

data al;
    merge alfa5 alfa10;
adjust="yes";
run;

data saml;
set saml al;
run;

%mend drlinje2;

data saml;
run;

%drlinje1(ltet51, matpfhx);
%drlinje2(ltet51, matpfhx,lpfsmat,lpfoamat);

%drlinje1(ltet51, matpfna);
%drlinje2(ltet51, matpfna,lpfsmat,lpfoamat);

%drlinje1(ltet51, matpfda);
%drlinje2(ltet51, matpfda,lpfsmat,lpfoamat);

%drlinje1(ldif51, matpfhx);
%drlinje2(ldif51, matpfhx,lpfsmat,lpfoamat);

%drlinje1(ldif51, matpfna);
%drlinje2(ldif51, matpfna,lpfsmat,lpfoamat);

%drlinje1(ldif51, matpfda);
%drlinje2(ldif51, matpfda,lpfsmat,lpfoamat);
```

```
data saml;  
set saml;  
if dependent='Itet51' then dependentyt='tetanus';  
if dependent='Idif51' then dependentyt='diphtheria';  
run;
```

```
data saml;  
set saml;  
format bmd bmdl bmd10 bmdl10 5.3;  
format m2lnl low_m2lnl 8.2;  
format probt 6.4;  
run;
```

```
data saml;  
  set saml;  
  if bmd=.then delete;  
    if bmd<0 then bmd=10000;  
    if bmdl<0 then bmdl=10000;  
  if bmd10<0 then bmd10=10000;  
  keep dependentyt exposure model adjust bmd bmdl bmd10 bmdl10;  
run;
```

```
proc print data=saml;  
var dependentyt exposure model adjust bmd bmdl;  
run;
```